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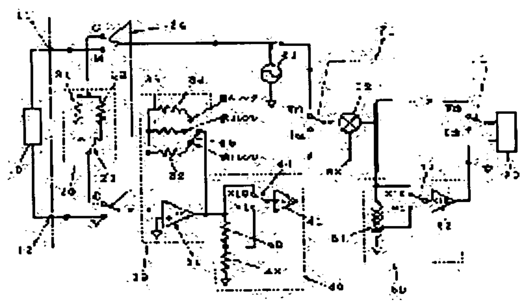
(54) APPARATUS FOR MEASURING IMPEDANCE

(57)Abstract:
PROBLEM TO BE SOLVED: To provide an apparatus for measuring impedance capable of simply and rapidly performing the calibrations of a plurality of impedance measuring ranges by one standard unit.
SOLUTION: The apparatus for measuring impedance is provided with a reference resistor 20, and automatically corrects the relative error between measuring ranges b using the resistor in an inner manner, and calibrates the one range by using one impedance standard unit thereby to correct all the absolute ranges. When the relative error between the ranges is corrected via the resistor, the measurement is conducted with a smaller vale than that of the full scale of the range, and the errors due to the resolution, linearity and S/N ratio are propagated between the ranges and accumulated. To prevent it, a signal normalizing unit 50 is connected before an A-D converter 70, and a signal normalizing unit 40 is connected before a frequency converter 52.



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CLAIMS

[Claim(s)]
[Claim 1] Impedance measurement equipment characterized by having a selecting switch and the reference impedance of one or more pieces, and having a reference impedance means by which the aforementioned selecting switch switches the aforementioned reference impedance alternatively, and the means for switching for switching the measuring object and the aforementioned reference impedance alternatively, and connecting with an impedance measurement means in impedance measurement equipment with two or more measurement ranges.
[Claim 2] Impedance measurement equipment according to claim 1 characterized by having further at least one signal specification means inserted in the system which measures the current of the measuring object.
[Claim 3] Impedance measurement equipment which is characterized by providing the following and which changes a test frequency into an intermediate frequency, measures the voltage and current of the measuring object, and calculates a desired impedance value. A reference impedance means by which have a selecting switch and the reference impedance of one or more pieces, and the aforementioned selecting switch switches the aforementioned reference impedance alternatively. The signal specification means with which the means for switching for switching the measuring object and the aforementioned reference impedance alternatively, and connecting with an impedance measurement means and the intermediate frequency stage of the system which measures the current of the measuring object were equipped.
[Claim 4] Impedance measurement equipment according to claim 3 characterized by having further the signal specification means with which the measurement-signal frequency stage of the system which measures the current of the measuring object was equipped.
[Claim 5] The claim 2 to which the aforementioned signal specification means is characterized by having two or more resistance, means for switching, and amplification meanses, and changing the gain of the aforementioned signal specification means by switching the aforementioned resistance alternatively by the aforementioned means for switching, impedance measurement equipment according to claim 3 or 4.
[Claim 6] The claim 2 to which the aforementioned signal specification means is characterized by having a transformer, means for switching, and an amplification means, and changing the gain of the aforementioned signal specification means by switching the aforementioned resistance alternatively by the aforementioned means for switching, impedance measurement equipment according to claim 3 or 4.
[Claim 7] The claim 1 characterized by the aforementioned reference impedance being resistance, a claim 2, impedance measurement equipment according to claim 3 or 4.
[Claim 8] The claim 1 characterized by making a market one reference impedance by one measurement range, measuring the reference impedance by which market-making was carried out [aforementioned] by other measurement ranges, and asking for the relative error between measurement ranges, a claim 2, a claim 3, impedance measurement equipment according to claim 4 or 7.
[Claim 9] The claim 2 characterized by switching the gain of the aforementioned signal specification means according to the size of the input level of the aforementioned signal specification means, and standardizing the output level of the aforementioned signal specification means when making a market one reference impedance by one measurement range, measuring the reference impedance by which market-making was carried out [aforementioned] by other measurement ranges and asking for the relative error between measurement ranges, a claim 3, or impedance measurement equipment according to claim 4.
[Claim 10] The proofreading method of the impedance measurement equipment which is equipped with SUTTEPU which measures a reference impedance and asks for the relative error between measurement ranges, the step which measures one impedance standard and proofreads one range, and the step which proofreads other range based on the range by which proofreading was carried out [aforementioned], and changes.

[Translation done.]

DETAILED DESCRIPTION

[Detailed Description of the Invention]
[0001]
[Industrial Application] this invention relates to impedance measurement equipment.
[0002]
[Description of the Prior Art] The principle of the typical impedance measurement equipment of the conventional technology is shown in the block diagram of drawing 4 . Impedance measurement equipment has the operation control section (not shown) which controls the source 51 of a measurement signal, the current-voltage transducer 30, the A-D transducer 70, a switch 71, and these.
[0003] The basic principle of measurement is as follows. A measurement signal is impressed to one terminal of the measuring object 10 through a sense terminal 11 from the source 51 of a measurement signal. Other terminals of the measuring object 10 are connected to the current-voltage transducer 30 through the sense terminal 12. The current-voltage transducer 30 has amplifier 31, the range resistance 32, 33, and 34, and the switch 35. The range resistance 32, 33, or 34 is chosen by the switch 35, and is connected between the input/output terminals of amplifier 31. Therefore, by the feedback circuit which consists of amplifier 31 and this resistance, the input of the current-voltage transducer 30 becomes equal to grounding potential. Moreover, the output becomes the voltage proportional to the input current.
[0004] Since it becomes grounding potential, the input 12, i.e., the sense terminal, of the current-voltage transducer 30, the output of the source 51 of a measurement signal, i.e., the voltage of a sense terminal 11, becomes equal to the voltage between the ends children of the measuring object 10. Therefore, if it connects with the Vch side which shows a switch 71 to drawing 4 and the source of a measurement signal is chosen, the A-D transducer 70 will measure the voltage of the measuring object. On the other hand, since the output voltage of the current-voltage transducer 30 is the voltage proportional to the current which flows to the measuring object 10, if a switch 71 connects with the Ich side and the output voltage of the current-voltage transducer 30 is chosen, the A-D transducer 70 will measure the current which flows to the measuring object 10.
[0005] With the composition of drawing 4 , measurement voltage is fixed, current is proportional to the admittance of the measuring object, and the full scale of measurement is determined by admittance. Therefore, it is more suitable to call with admittance rather than it calls a measurement range with an impedance. a ratio with I which the admittance measured value Ydut of the measuring object connected to the acquired values V and Ich which connected the switch 71 to Vch as mentioned above, and carried out A-D conversion, and was obtained — it becomes what multiplied I/V by the conductance Gi of range resistance (32, 33, or 34) Namely, [0006]
[Equation 1]

$$Ydut = Gi \cdot I / V \qquad (1)$$

[0007] Here i shows the name of a range. An operation control section performs this calculation. Since the current which flows to the measuring object changes sharply with the impedance value (admittance value) of the measuring object, the range resistance 32, 33, and 34 was switched with a switch 35, and it has changed into the size which can measure output voltage with a sufficient precision by the A-D transducer 70. In addition, in drawing 4 , although the number of measurement ranges is set to 3, it does not restrict to this.
[0008] It is proofread by two or more standards (working standard) with the impedance measurement equipment of composition of switching two or more measurement ranges. The value of each standard (working standard) is the correspondence range, and it is chosen so that a full scale may be given to the A-D transducer 70. That is, it is chosen so that the measurement SN ratio best in each range may be obtained. The measured value amended by the operation of the following formula is obtained using the correction factor Ki obtained by this proofreading.
[0009]
[Equation 2]

$$Ydut = Ki \cdot Gi \cdot I / V \qquad (2)$$

[0010] The number of the conventional method of preparing the standard of the number of measurement ranges and proofreading for every measurement range of standards increased, and the man day which cost, management, and proofreading take had also become a manufacturer under the burden also at the user. The equipment or the function which can be proofread by one standard is ideal also for a user also for a manufacturer. However, if it is going to proofread conventional impedance measurement equipment by one standard, although suitable proofreading can be performed in a certain range, it will be forced proofreading in the situation which is not filled to 1 full-scale%, either in other range. It is not necessary to explain that such a proofreading method is inapplicable to the impedance measurement equipment of a latus measurement range in full detail.
[0011]
[Problem(s) to be Solved by the Invention] In impedance measurement equipment, two or more standards for proofreading are required for proofreading of two or more measurement ranges, and it took the long time at proofreading to them. The technical problem which this invention tends to solve is offering the impedance measurement equipment which can carry out simply quickly proofreading of two or more impedance measurement range by one standard.
[0012]
[Means for Solving the Problem] The basic means of this invention is a thing of all range proofread absolutely, when impedance

measurement equipment is equipped with a reference impedance group, amends the relative error between measurement ranges automatically internally using this reference impedance and proofreads one range using one impedance standard. The above-mentioned basic means makes a reference impedance agency, in the relative error between range, it is an amendment and measurement with a small value is not avoided compared with the full scale of a range. Consequently, the error by resolution, linearity, and the SN ratio spreads and accumulates between range. In order to prevent this, it prefaces to the A-D transducer and frequency converter which these errors produce, the signal specification section is prepared, and measurement with a small value is avoided compared with a full scale.

[0013]

[Example] As the 1st example of this invention, the composition of the above-mentioned basic means is shown in drawing 2 . The same reference mark is given to the same component as drawing 4 of the conventional technology. The 1st example is an example which used resistance for the reference impedance for measuring the relative error between measurement ranges. The switch 24 which switches the reference resistance section 20 and the reference resistance section 20, and the measuring object 10 is added to the conventional technology shown in drawing 4 . In addition, the resistance 21 and 22 of the reference resistance section 20 does not need to be proofread. Moreover, long term stability is also unnecessary. It is [0014] which is not what sets the number of measurement ranges to 3 for explanation and the assistance of an understanding, and restricts this invention to these values although it of 10mS(s) and the 3rd range is materialized [the charge of each range / the full scale of the 1st range] for it of 100mS(s) and the 2nd range with 1mS at intervals of 10 times. The method of measuring the relative error between range and proofreading the absolute error of all range is as follows. This is performed by control of an operation control section (not shown). First, it starts with changing into the state of connecting with the C side (reference resistance section side) which shows a switch 24 to drawing 2 , and measuring the reference resistance section 20, and proofreading the relative error between range. The reference resistance 21 of 10mS(s) is chosen with a switch 23, a switch 35 is used as a 100mS range (the 1st range), and it measures by 10% of the admittance full scale.

[0015] Next, a switch 23 is left to reference resistance of 10mS(s), a switch 35 is used as 10mS range (the 2nd range), and full-scale measurement is carried out. If the measured value of Y1 and the latter is expressed for the former measured value as Y2, the ratio K12 of the correction factors K1 and K2 in (2) formulas will become like the following formula.

[0016]

[Equation 3]

$$K12 = K1 / K2 = Y2 / Y1 \qquad (3)$$

[0017]

TECHNICAL FIELD

[Industrial Application] this invention relates to impedance measurement equipment.

[Translation done.]

PRIOR ART

[Description of the Prior Art] The principle of the typical impedance measurement equipment of the conventional technology is shown in the block diagram of drawing 4 . Impedance measurement equipment has the operation control section (not shown) which controls the source 51 of a measurement signal, the current-voltage transducer 30, the A-D transducer 70, a switch 71, and these.
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[0004] Since it becomes grounding potential, the input 12, i.e., the sense terminal, of the current-voltage transducer 30, the output of the source 51 of a measurement signal, i.e., the voltage of a sense terminal 11, becomes equal to the voltage between the ends children of the measuring object 10. Therefore, if it connects with the Vch side which shows a switch 71 to drawing 4 and the source of a measurement signal is chosen, the A-D transducer 70 will measure the voltage of the measuring object. On the other hand, since the output voltage of the current-voltage transducer 30 is the voltage proportional to the current which flows to the measuring object 10, if a switch 71 connects with the Ich side and the output voltage of the current-voltage transducer 30 is chosen, the A-D transducer 70 will measure the current which flows to the measuring object 10.
[0005] With the composition of drawing 4 , measurement voltage is fixed, current is proportional to the admittance of the measuring object, and the full scale of measurement is determined by admittance. Therefore, it is more suitable to call with admittance rather than it calls a measurement range with an impedance. a ratio with I which the admittance measured value Ydut of the measuring object connected to the acquired values V and Ich which connected the switch 71 to Vch as mentioned above, and carried out A-D conversion, and was obtained -- it becomes what multiplied I/V by the conductance Gi of range resistance (32, 33, or 34) Namely, [0006]
[Equation 1]

$$Ydut = Gi \cdot I / V \qquad (1)$$

[0007] Here i shows the name of a range. An operation control section performs this calculation. Since the current which flows to the measuring object changes sharply with the impedance value (admittance value) of the measuring object, the range resistance 32, 33, and 34 was switched with a switch 35, and it has changed into the size which can measure output voltage with a sufficient precision by the A-D transducer 70. In addition, in drawing 4 , although the number of measurement ranges is set to 3, it does not restrict to this.
[0008] It is proofread by two or more standards (working standard) with the impedance measurement equipment of composition of switching two or more measurement ranges. The value of each standard (working standard) is the correspondence range, and it is chosen so that a full scale may be given to the A-D transducer 70. That is, it is chosen so that the measurement SN ratio best in each range may be obtained. The measured value amended by the operation of the following formula is obtained using the correction factor Ki obtained by this proofreading.
[0009]
[Equation 2]

$$Ydut = Ki \cdot Gi \cdot I / V \qquad (2)$$

[0010] The number of the conventional method of preparing the standard of the number of measurement ranges and proofreading for every measurement range of standards increased, and the man day which cost, management, and proofreading take had also become a manufacturer under the burden also at the user. The equipment or the function which can be proofread by one standard is ideal also for a user also for a manufacturer. However, if it is going to proofread conventional impedance measurement equipment by one standard, although suitable proofreading can be performed in a certain range, it will be forced proofreading in the situation which is not filled to 1 full-scale%, either in other range. It is not necessary to explain that such a proofreading method is inapplicable to the impedance measurement equipment of a latus measurement range in full detail.

[Translation done.]

EFFECT OF THE INVENTION

[Effect of the Invention] As explained above, according to this invention, the impedance measurement equipment of composition of taking charge of the large impedance range in two or more range can be proofread simply quickly by one impedance standard. About the impedance measurement equipment of a wide band, it is still more effective and the kind of standard for proofreading is not limited to resistance and one of capacitors, either. Furthermore, it is also easy at the time of manufacture shipment for the user of quick proofreading or quick adjustment being not only possible but equipment to reproofread equipment on the basis of the standard which self owns. Moreover, it presents practical use and is useful, without the problem of the measured-value jump between the range by using two or more standards arising, or the traceability of measured value becoming not clear.

[Translation done.]

TECHNICAL PROBLEM

[Problem(s) to be Solved by the Invention] In impedance measurement equipment, two or more standards for proofreading are required for proofreading of two or more measurement ranges, and it took the long time at proofreading to them. The technical problem which this invention tends to solve is offering the impedance measurement equipment which can carry out simply quickly proofreading of two or more impedance measurement range by one standard.

[Translation done.]

MEANS

[Means for Solving the Problem] The basic means of this invention is a thing of all range proofread absolutely, when impedance measurement equipment is equipped with a reference impedance group, amends the relative error between measurement ranges automatically internally using this reference impedance and proofreads one range using one impedance standard. The above-mentioned basic means makes a reference impedance agency, in the relative error between range, it is an amendment and measurement with a small value is not avoided compared with the full scale of a range. Consequently, the error by resolution, linearity, and the SN ratio spreads and accumulates between range. In order to prevent this, it prefaces to the A-D transducer and frequency converter which these errors produce, the signal specification section is prepared, and measurement with a small value is avoided compared with a full scale.

[Translation done.]

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DESCRIPTION OF DRAWINGS

[Brief Description of the Drawings]
[Drawing 1] It is drawing showing the 3rd example of this invention.
[Drawing 2] It is drawing showing the 1st example of this invention.
[Drawing 3] It is drawing showing the 2nd example of this invention.
[Drawing 4] It is drawing showing the example of the conventional technology.
[Description of Notations]
10: Measuring object
11: Sense terminal
12: Sense terminal
20: Reference resistance section
21: Resistance
22: Resistance
23: Switch
24: Switch
30: Current-voltage transducer
31: Amplifier
32: The 1st range resistance
33: The 2nd range resistance
34: The 3rd range resistance
35: Switch
40: Signal specification section
41: Amplifier
42: Resistance
43: Resistance
44: Switch
51: The source of a measurement signal
52: Frequency converter
53: Local signal
60: Signal specification section
61: Transformer
62: Amplifier
63: Switch
70: A-D transducer
71: Switch

[Translation done.]

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* NOTICES *

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1.This document has been translated by computer. So the translation may not reflect the original precisely.
2.**** shows the word which can not be translated.
3.In the drawings, any words are not translated.

EXAMPLE

[Example] As the 1st example of this invention, the composition of the above-mentioned basic means is shown in drawing 2 . The same reference mark is given to the same component as drawing 4 of the conventional technology. The 1st example is an example which used resistance for the reference impedance for measuring the relative error between measurement ranges. The switch 24 which switches the reference resistance section 20 and the reference resistance section 20, and the measuring object 10 is added to the conventional technology shown in drawing 4 . In addition, the resistance 21 and 22 of the reference resistance section 20 does not need to be proofread. Moreover, long term stability is also unnecessary. It is [0014] which is not what sets the number of measurement ranges to 3 for explanation and the assistance of an understanding, and restricts this invention to these values although it of 10mS(s) and the 3rd range is materialized [the charge of each range / the full scale of the 1st range] for it of 100mS(s) and the 2nd range with 1mS at intervals of 10 times. The method of measuring the relative error between range and proofreading the absolute error of all range is as follows. This is performed by control of an operation control section (not shown). First, it starts with changing into the state of connecting with the C side (reference resistance section side) which shows a switch 24 to drawing 2 , and measuring the reference resistance section 20, and proofreading the relative error between range. The reference resistance 21 of 10mS(s) is chosen with a switch 23, a switch 35 is used as a 100mS range (the 1st range), and it measures by 10% of the admittance full scale.
[0015] Next, a switch 23 is left to reference resistance of 10mS(s), a switch 35 is used as 10mS range (the 2nd range), and full-scale measurement is carried out. If the measured value of Y1 and the latter is expressed for the former measured value as Y2, the ratio K12 of the correction factors K1 and K2 in (2) formulas will become like the following formula.
[0016]
[Equation 3]

$$K12 = K1 / K2 = Y2 / Y1 \qquad (3)$$

[0017] Next, if the reference resistance 22 of 1mS is chosen with a switch 23 and it measures in 10mS range (the 2nd range) and 1mS range (the 3rd range), K23 (=K2/K3) will be calculated. Thus, all the relative errors between range become clear. Finally a switch 24 is moved to the M position (sense-terminal side), and absolute value proofreading of all range is completed by measuring the standard for proofreading in a proper range. For example, it is as follows when Ystd is measured in the 2nd range.
[0018]
[Equation 4]

$$K2 = Ystd / (G2 \cdot (I / V))$$

$$K1 = K12 \cdot K2$$

$$K3 = K2 / K23$$

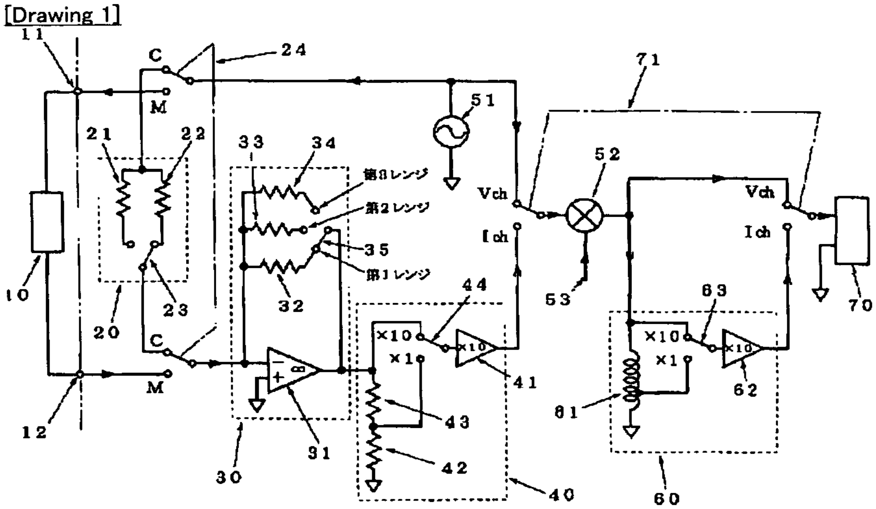
[0019] As mentioned above, if a reference impedance is built in impedance measurement equipment and switched one by one, the automatic calibration of all the range can be carried out by control of an operation control section. In addition, reference resistance can be first made a market by the full scale, and it can proofread also not in the sequence of above-mentioned range proofreading but in the reverse procedure of next proofreading a range 10% by this reference resistance. Moreover, the sequence of performing the proofreading by the standard resistance first is sufficient.
[0020] In the 1st example shown in drawing 2 , as for measurement (it is henceforth written as measurement 10%) at 10 full-scale%, the accuracy of measurement falls compared with the time of a full scale. Consequently, an error spreads between range by the above-mentioned proofreading and the repeat of market-making, and there is a fault accumulated. The factor of this error is degradation of the SN ratio at the time of 10% measurement, resolution, and linearity.
[0021] The noise consisted of the thermal noise and shot noise of each element which constitute a circuit, and is produced in superposition to the signal. By measurement, an SN ratio becomes 1/10 [at the time of a full scale] 10%. If the statistics rule of a gauss noise is followed, in order to obtain the same measurement reproducibility as the time of a full scale (measurement error standard deviation), the 100 times [at the time of a full scale] as many measuring time as this will be required. Moreover, the quantization interval of a A-D transducer and its heterogeneity worsen the resolution and linearity of measurement at the time of a small signal. If a simple model is followed at the time of 10% measurement, the error resulting from them will increase 10 times. Therefore, even if the 1st example increases proofreading time, the increase in with error is not avoided but is unsuitable for proofreading of a latus measurement range or highly precise impedance measurement equipment.
[0022] A means to solve the problem of the 1st example is shown in drawing 3 as the 2nd example. The proofreading sequence of the reference resistance section 20 and the error between range is the same as that of the 1st example. Although the 2nd example also sets the number of measurement ranges to 3 and has materialized the charge impedance of each range with the interval 10 times for explanation and the assistance of an understanding, a value is not restricted to this.
[0023] In order to remove accumulation of the error by the resolution of the A-D transducer 70, and degradation of linearity, the preceding paragraph of the A-D transducer 70 is equipped with the signal specification section 60. The signal specification

section 60 has a transformer 61, amplifier 62, and the switch 63. In the example shown in drawing 3 , a transformer 61 has the output terminal which pressures input voltage partially to 1/10, and the gain of amplifier 62 is 10. Therefore, if a switch 63 chooses xten shown in drawing 3 , the gain of the signal specification section 60 will increase 10 times. Moreover, if it switches to a switch 63x1, the gain of the signal specification section 60 will increase 1 time.
[0024] If the gain of the signal specification section 60 is increased 1 time by full-scale measurement and it increases 10 times by measurement 10% when carrying out the error correction between range, the input of the A-D transducer 70 will be standardized by the full scale, the dynamic range of the appearance of a A-D transducer will improve remarkably, and the influence of the error by degradation of resolution and linearity will be removed.
[0025] Not the 1 time and 10 times as many value itself as this but a gain ratio is important for the precision of the gain of the signal specification section 60. With a several ppm error, since the partial pressure of an integer ratio is possible for a transformer, if a transformer is used, it does not need to proofread the gain of the signal specification section 60. In addition, it is also possible to transpose the transformer 61 of the signal specification section 60 to a resistance partial pressure depending on the accuracy of measurement or the test frequency of an impedance measuring equipment.
[0026] Next, as the 3rd example of this invention, a test frequency shows the example of the impedance measurement equipment of the wide band of 100Hz - 100MHz to drawing 1 . It is [0027] which is not what restricts this invention to these values although the number of measurement ranges is set to 3 for explanation and the assistance of an understanding. High-frequency band impedance measurement equipment is conventionally realized in many cases by the superheterodyne method. By the superheterodyne method, after being mixed with the local signal 53 by the frequency converter 52 and changing a test frequency into an intermediate frequency, it is measured by the A-D transducer 70.
[0028] In order to remove accumulation of the error by the resolution of the A-D transducer 70, and degradation of linearity, it has the signal specification section 60 in the intermediate frequency stage in the preceding paragraph of the A-D transducer 70. This signal specification section 60 carries out the same operation as the signal specification section 60 of the 2nd example.
[0029] However, by the heterodyne method, the problem of an SN ratio is not solved only by the method of adding the signal specification section 60 of the A-D transducer 70 above-mentioned preceding paragraph. Usually, in a heterodyne method, an SN ratio becomes settled in the die NAMMIKU range of a frequency converter 52. By measurement, an SN ratio becomes 1/10 [at the time of full-scale measurement] 10%. In order to obtain the same measurement error standard deviation as the time of a full scale, the 100 times [at the time of a full scale] as many measuring time as this is required.
[0030] Then, if the signal specification section is further prepared in the test-frequency stage of the preceding paragraph of a frequency converter 52 and gain is set as xten at the time of 10% measurement of range relative error proofreading, it will be in Ming that an SN ratio is improvable. The composition is illustrated in the signal specification section 40 of drawing 1 . In the example of drawing 1 , the signal specification section 40 has the potentiometer, the switch 44, and amplifier 41 which consist of resistance 43 and 42. If gain is set up 10 times like the signal specification section 60 at the time of 10% measurement, the problem of the noise by the frequency converter 52 is solvable.
[0031] However, the potentiometer of the proofreading needlessness of ppm order cannot be made from the wide band of 100MHz from 100Hz. Then, the division ratio of the signal specification section 40 is taken as the object of proofreading like an impedance range. For example, if you switch 40 to the signal specification section x10 and x1, you make it this interlocked with and 60 is switched and measured in the signal specification section x1 and x10 of the intermediate frequency stage by setup (10% measurement) which measures 1mS reference resistance in 10mS range, degradation of A-D conversion will be uninfluential and the exact gain ratio of the signal specification section 40 will be called for.
[0032] However, on the gain of xone, since a S/N ratio is still bad as usual at a frequency converter 52, proofreading of this signal specification section 40 takes the 100 times as many measuring time as this. However, even if the proofreading which requires 100 times as many time as this is required, there are the following two effects in this signal specification section 40. In proofreading of impedance measurement equipment with N measurement ranges, 10% measurement is required once [N-]. On the other hand, since 10% measurement required for proofreading of the signal specification section 40 is good at once, shortening of proofreading time is possible.
[0033] Another effect originates in the need for frequency characteristic amendment of wide-band impedance measurement equipment. When plurality and its value straddle [range resistance] broadly, there is a big difference in the frequency characteristic between range for the switch circuit around a parasitic capacitance or around [the]. So, even if, many proofreading frequency points are needed on the assumption that frequency interpolation interpolation. Since the signal specification section 40 can be constituted from a simple circuit compared with this, what also has the flat frequency characteristic is obtained. A proofreading frequency point required for a interpolation amendment is good at about [as opposed to / a range / for the perimeter wave number band of the signal specification section 40 / of that] 1/10.
[0034] As mentioned above, the example which solves a problem [in / measurement / for wide band impedance measurement equipment] 10% for an example was shown. The A-D conversion error problem decreased time required for a dissolution and reservation of an SN ratio. The proofreading time which increases two-dimensional in the combination of the direction of a range and the frequency direction is decreased to less than one dimension.
[0035] Although one standard for proofreading is connected with a sense terminal 11 between 12, and this is measured in a proper range and being absolutely proofread the relative error proofreading front between range, or after completion in this invention, the conditions about this standard are described at the end. It is clear that it is easy to treat what resistance and it also give a full scale in a certain range as a standard for proofreading of wide-band impedance measurement equipment. However, it is not limited to resistance. A standard capacitor can also be used if auto ranging is performed carrying out a frequency sweep since absolute value proofreading will attain to all range by the relative-value calibration function, if the absolute value proofreading of any one range is carried out.
[0036] However, possibility that the voltage near [to set up more finely a gain switch of the signal specification sections 40 and 60 in this case / the A-D transducer 70] a full scale can always be inputted becomes high, and is effective. Although the example of this invention was shown above, the format of instantiation, arrangement, and others are not limited, and change of composition is also permitted, without losing the summary of this invention if needed.

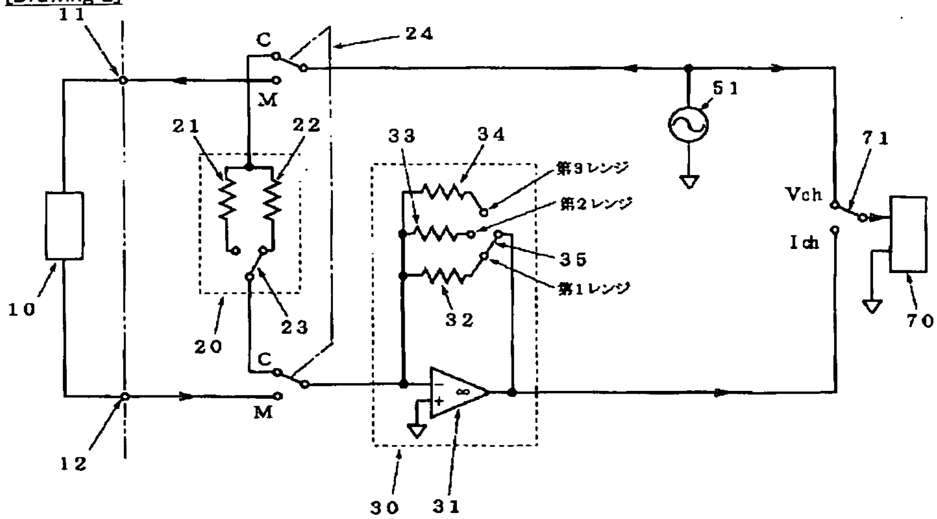
[Translation done.]

DRAWINGS

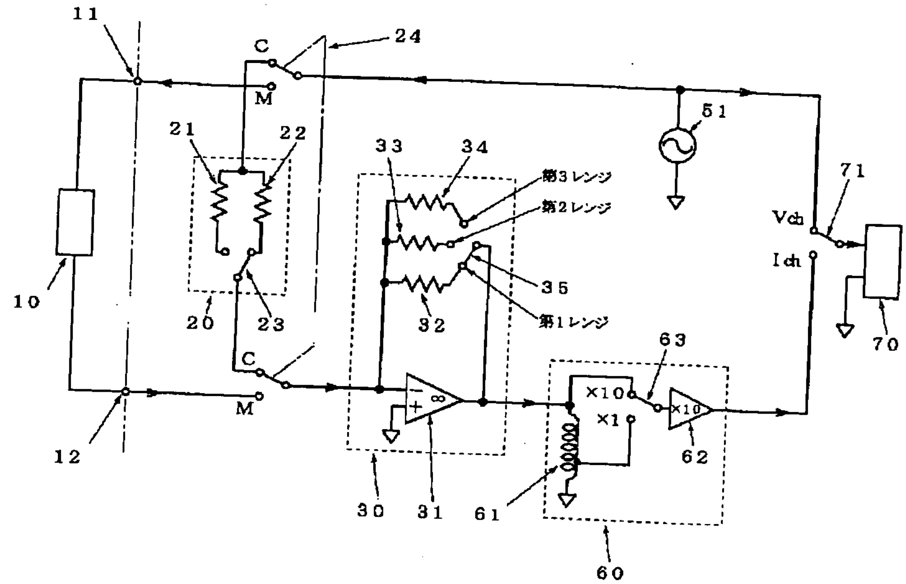
[Drawing 1]



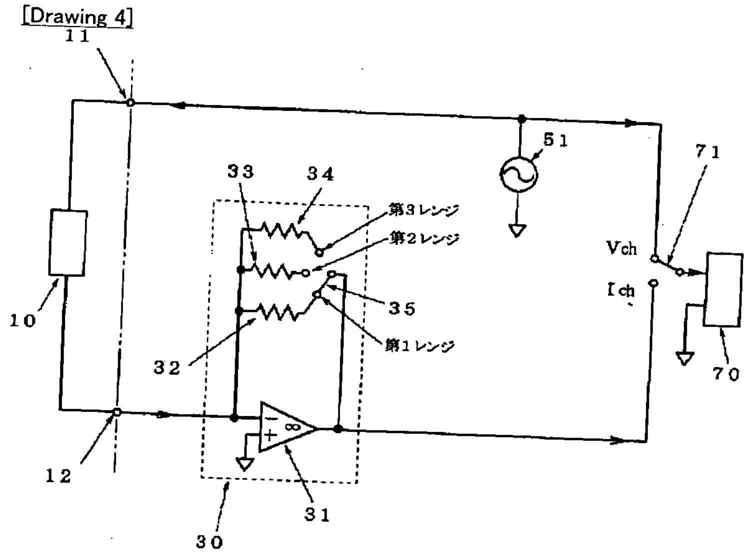
[Drawing 2]



[Drawing 3]



[Drawing 4]



[Translation done.]

CORRECTION or AMENDMENT

[Official Gazette Type] Printing of amendment by the convention of 2 of Article 17 of patent law.
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[Filing Date] April 2, Heisei 15 (2003. 4.2)
[Procedure amendment 1]
[Document to be Amended] Specification.
[Item(s) to be Amended] Claim.
[Method of Amendment] Change.
[Proposed Amendment]
[Claim(s)]
[Claim 1] Impedance measurement equipment characterized by having a selecting switch and the reference impedance of one or more pieces, and having a reference impedance means by which the aforementioned selecting switch switches the aforementioned reference impedance alternatively, and the means for switching for switching the measuring object and the aforementioned reference impedance alternatively, and connecting with an impedance measurement means in impedance measurement equipment with two or more measurement ranges.
[Claim 2] Impedance measurement equipment according to claim 1 characterized by having further at least one signal specification means inserted in the system which measures the current of the measuring object.
[Claim 3] Impedance measurement equipment which is characterized by providing the following and which changes a test frequency into an intermediate frequency, measures the voltage and current of the measuring object, and calculates a desired impedance value. A reference impedance means by which have a selecting switch and the reference impedance of one or more pieces, and the aforementioned selecting switch switches the aforementioned reference impedance alternatively. The first signal specification means with which the means for switching for switching the measuring object and the aforementioned reference impedance alternatively, and connecting with an impedance measurement means and the intermediate frequency stage of the system which measures the current of the measuring object were equipped.
[Claim 4] Impedance measurement equipment according to claim 3 characterized by having further the second signal specification means with which the measurement-signal frequency stage of the system which measures the current of the measuring object was equipped.
[Claim 5] Impedance measurement equipment according to claim 1 to 4 characterized by making a market one reference impedance by one measurement range, measuring the reference impedance by which market-making was carried out [aforementioned] by other measurement ranges, and asking for the relative error between measurement ranges.
[Claim 6] Impedance measurement equipment according to claim 2 to 4 characterized by switching the gain of the aforementioned signal specification means according to the size of the input level of the aforementioned signal specification means, and standardizing the output level of the aforementioned signal specification means when making a market one reference impedance by one measurement range, measuring the reference impedance by which market-making was carried out [aforementioned] by other measurement ranges and asking for the relative error between measurement ranges.
[Claim 7] Impedance measurement equipment according to claim 2 to 6 with which the aforementioned signal specification means is characterized by having two or more resistors, means for switching, and amplification meanses, and changing the gain of the aforementioned signal specification means by switching the aforementioned resistor alternatively by the aforementioned means for switching.
[Claim 8] Impedance measurement equipment according to claim 2 to 6 with which the aforementioned signal specification means is characterized by having a transformer, means for switching, and an amplification means, and changing the gain of the aforementioned signal specification means by switching the output terminal of the aforementioned transformer alternatively by

the aforementioned means for switching.
[Claim 9] The claim 1 characterized by the aforementioned reference impedance being a resistor, a claim 2, impedance measurement equipment according to claim 3 or 4.
[Claim 10] The proofreading method of the impedance measurement equipment which is equipped with the step which measures a reference impedance and asks for the relative error between measurement ranges, the step which measures one impedance standard and proofreads one range, and the step which proofreads other range based on the range by which proofreading was carried out [aforementioned], and changes.

[Translation done.]